

Karma

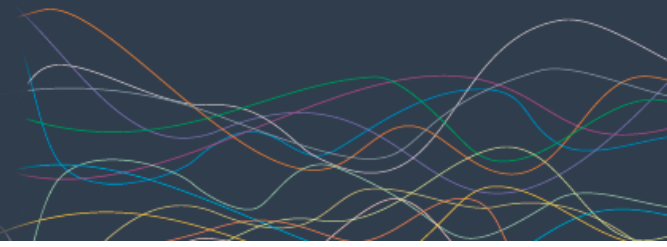
A Data Integration Tool

Karma is a Tool!

prepared for VIVO 2015 Managing Your Data Flows: Architecture and Data Provenance
For Your Institution Workshop

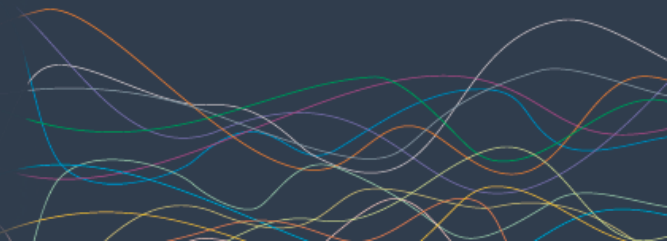
Violeta Ilik

Galter Health Sciences Library
Feinberg School of Medicine
Northwestern University Clinical and
Translational Sciences Institute (NUCATS), Chicago, IL



Outline:

- Examine your data
- Clean your data
- Create local ontology extensions (optional)
- Model your data
- Load your data



Examine your data

Accommodate within existing ontologies most of your data

Opt for local extensions if necessary

- Local unique identifiers (people & organizations)
- Specific needs (publication types; non-traditional scholarly outputs ...)

Clean your data

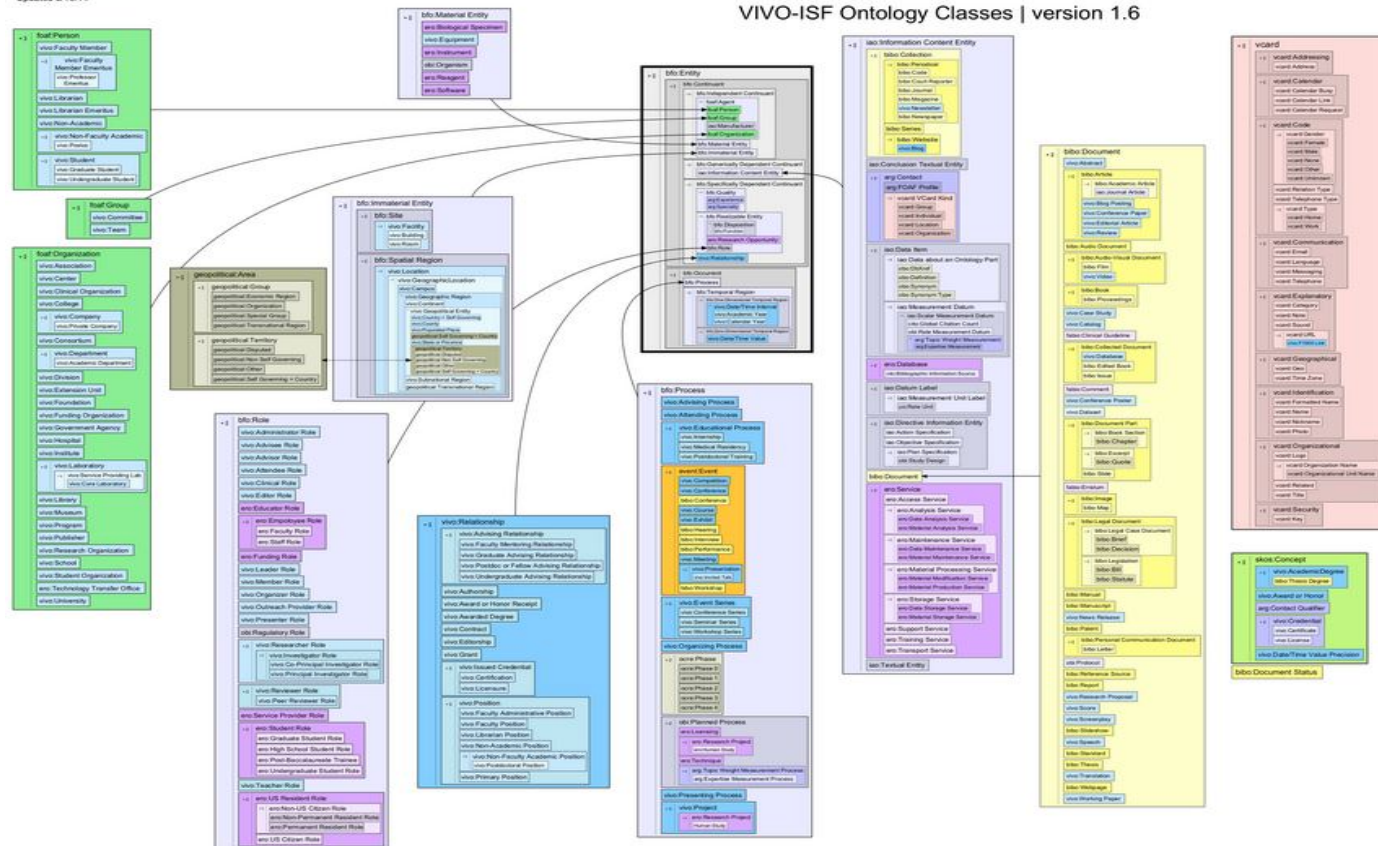
Utilizing local resources and skills

- polyglot programming skills (Python, Perl, XSLT, SAS, R, OpenRefine)

Ontology: VIVO-ISF

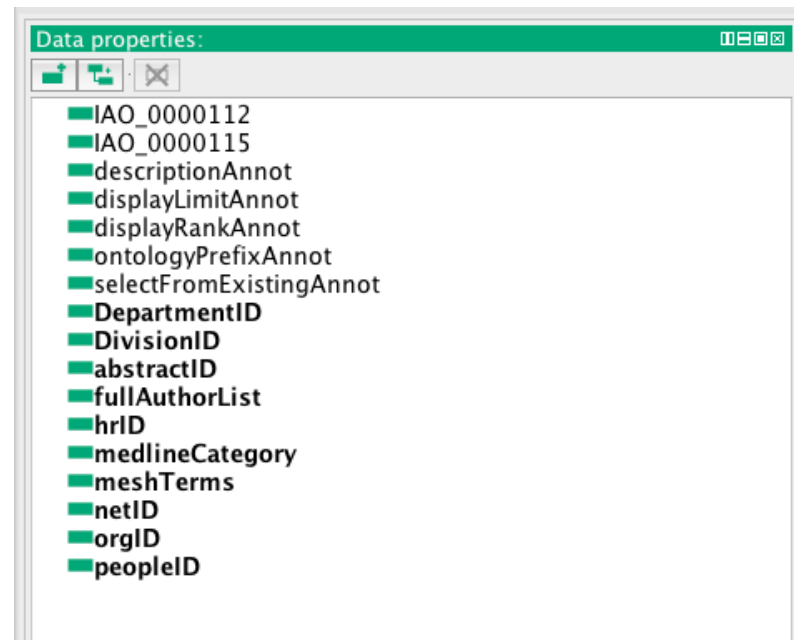
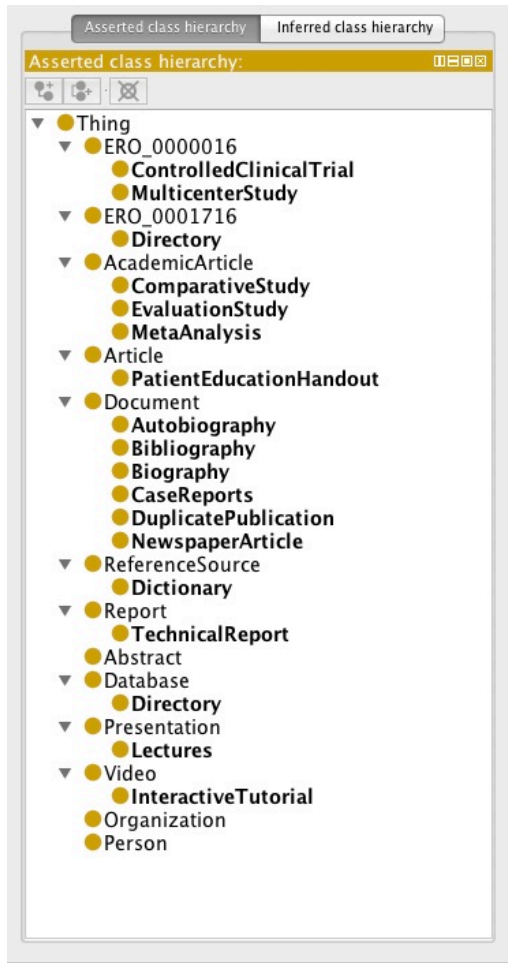
Updated 3/16/14

VIVO-ISF Ontology Classes | version 1.6



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Ontology: local extensions





Karma enables integration of:

- CSV/TSV files
- XML
- JSON
- Databases
- KML
- Web APIs



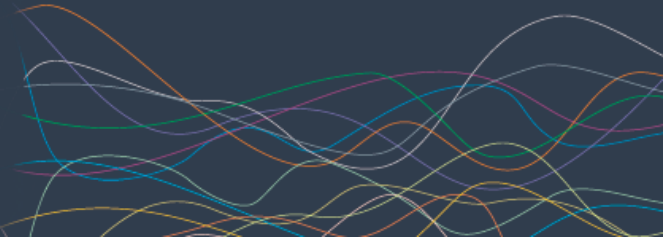
The modeling consists of four steps:

1. Assign Semantic Types

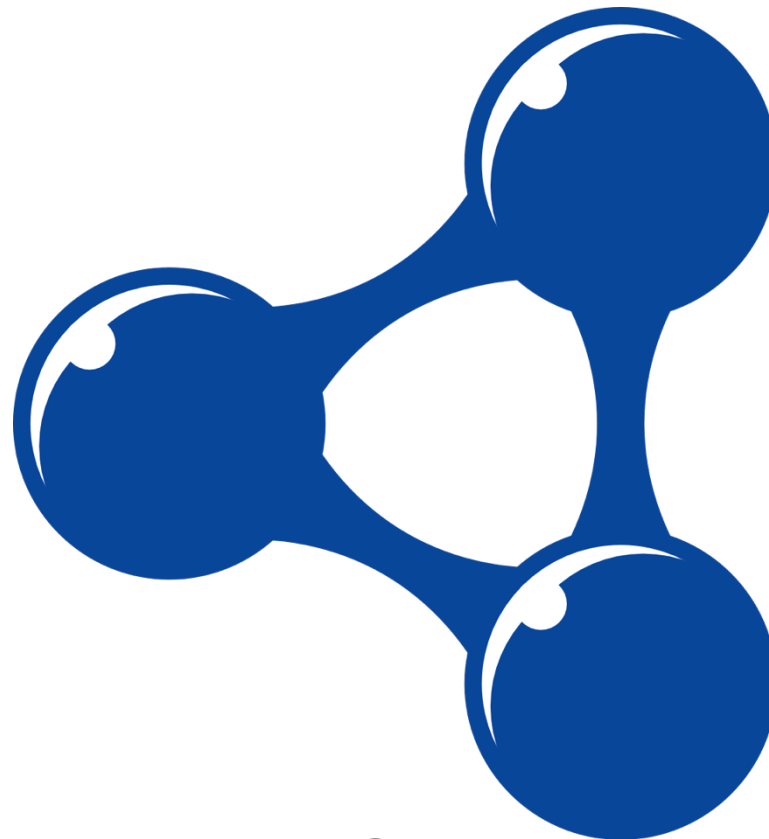
2. Constructing the Graph

3. Refine Source Model

4. Generate Formal Specification

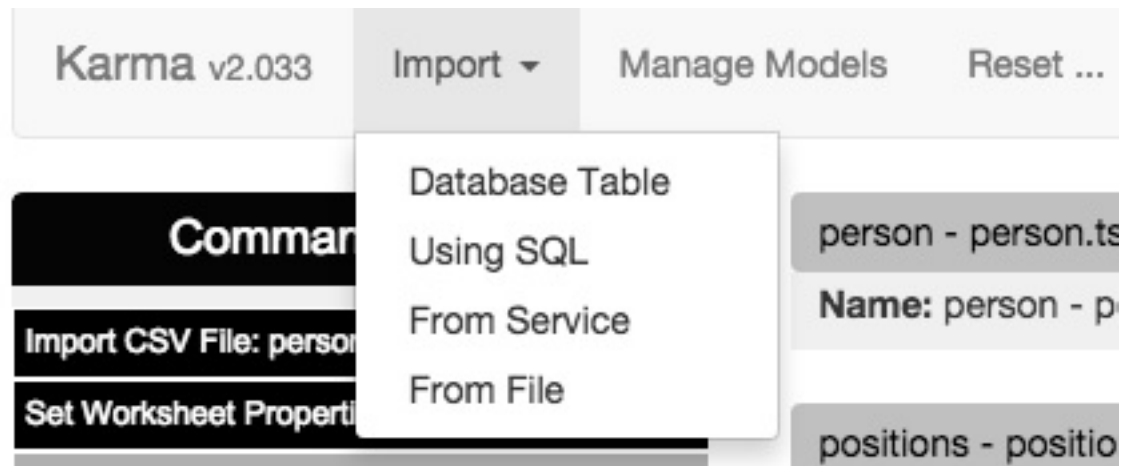


Result



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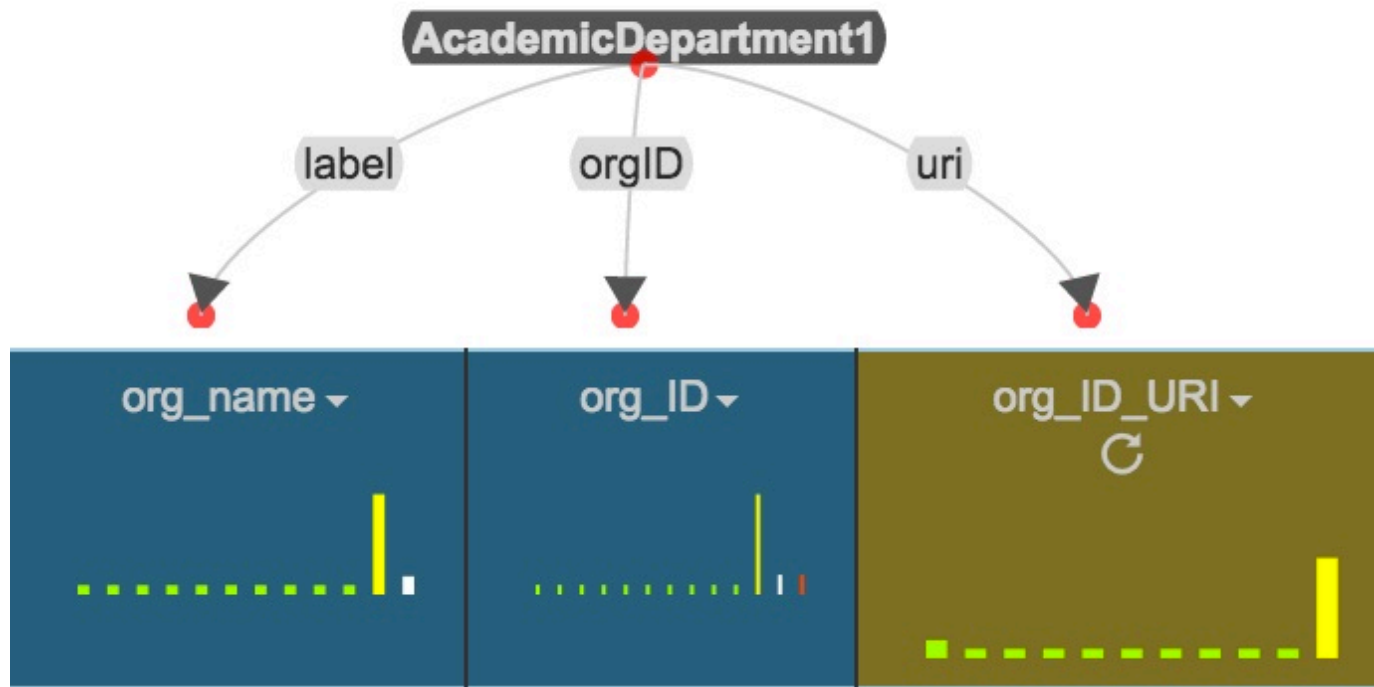
Karma Import options:



Importing CSV/TSV files

org_name ▼	org_ID ▼	org_IDuri ▼ C
Accounting	8b9df681	http://vivo.northwester...
Aerospace Engineering	e5c84f0a	http://vivo.northwester...
Agriculture Leadership Education and Communication	2d953da5	http://vivo.northwester...

Modeling organizations/units data



R2RML - RDB to RDF Mapping Language

“R2RML, a language for expressing customized mappings from relational databases to RDF datasets. Such mappings provide the ability to view existing relational data in the RDF data model, expressed in a structure and target vocabulary of the mapping author's choice. R2RML mappings are themselves RDF graphs and written down in Turtle syntax. R2RML enables different types of mapping implementations. Processors could, for example, offer a virtual SPARQL endpoint over the mapped relational data, or generate RDF dumps, or offer a Linked Data interface.”

<http://www.w3.org/TR/r2rml/>

R2RML

```

_:node19s213a13x1 a km-dev:R2RMLMapping ;
    km-dev:sourceName "organisations - organisations.tsv" ;
    km-dev:modelPublicationTime "1438882310179"^^xsd:long ;
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    km-dev:hasBaseURI "http://localhost:8080/source/" ;
    km-dev:hasWorksheetHistory ""[

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      \value\": \"W\"
    },
    {
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      \type\": \"other\",
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    },
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      \value\": [{
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        \DomainId\": \"http://vivoweb.org/ontology/core#AcademicDepartment1\",
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    ]
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}

```

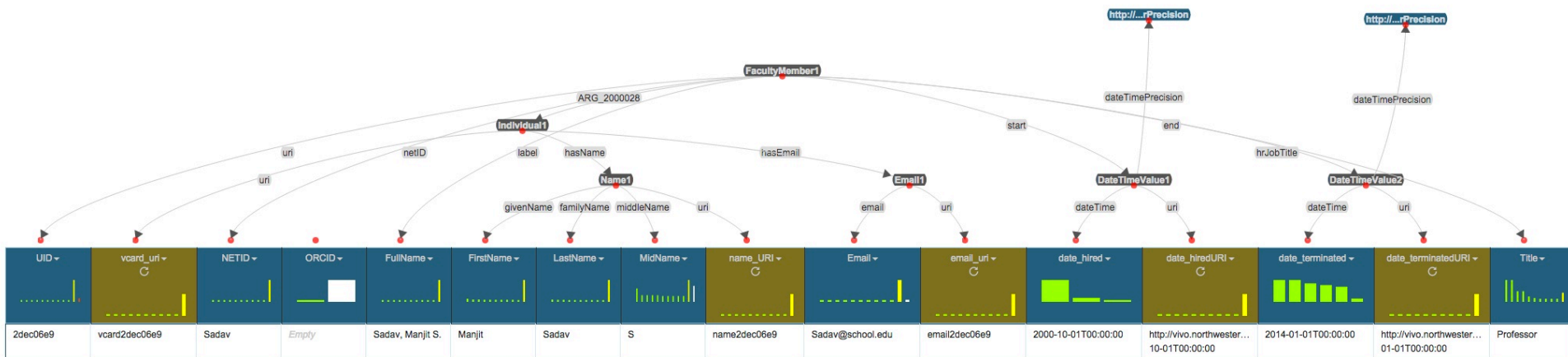
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Workbench: organizations/units N-Triples

Subject	Predicate	Object	Context
< http://vivo.northwestern.edu/n8b9df681 >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n8b9df681 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Accounting"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n8b9df681 >	< http://vivo.northwestern.edu/ontology/vlocal#orgID >	"8b9df681"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/ne5c84foa >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/ne5c84foa >	< http://www.w3.org/2000/01/rdf-schema#label >	"Aerospace Engineering"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/ne5c84foa >	< http://vivo.northwestern.edu/ontology/vlocal#orgID >	"e5c84foa"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2d953da5 >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2d953da5 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Agriculture Leadership Education and Communication"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2d953da5 >	< http://vivo.northwestern.edu/ontology/vlocal#orgID >	"2d953da5"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2735b399 >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2735b399 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Animal Science"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n2735b399 >	< http://vivo.northwestern.edu/ontology/vlocal#orgID >	"2735b399"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n26ddd99c >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n26ddd99c >	< http://www.w3.org/2000/01/rdf-schema#label >	"Anthropology"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
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< http://vivo.northwestern.edu/n3c372a44 >	< http://www.w3.org/1999/02/22-rdf-syntax-ns#type >	< http://vivoweb.org/ontology/core#AcademicDepartment >	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n3c372a44 >	< http://www.w3.org/2000/01/rdf-schema#label >	"Architecture"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >
< http://vivo.northwestern.edu/n3c372a44 >	< http://vivo.northwestern.edu/ontology/vlocal#orgID >	"3c372a44"	< http://localhost.com/worksheets/organisations - organisations_tsv/vivo15 >

Modeling the person file



Incoming-Outgoing links: Individual

Incoming-Outgoing Links for: Individual1 ×

Incoming Links:

from	vivo:FacultyMember1	via	obo:ARG_2000028	Delete	Edit
------	---------------------	-----	-----------------	--------	------

Outgoing Links:

to	vcard:Email1	via	vcard:hasEmail	Delete	Edit
to	vcard:Name1	via	vcard:hasName	Delete	Edit

Add Incoming Link

Add Outgoing Link

Cancel

Save

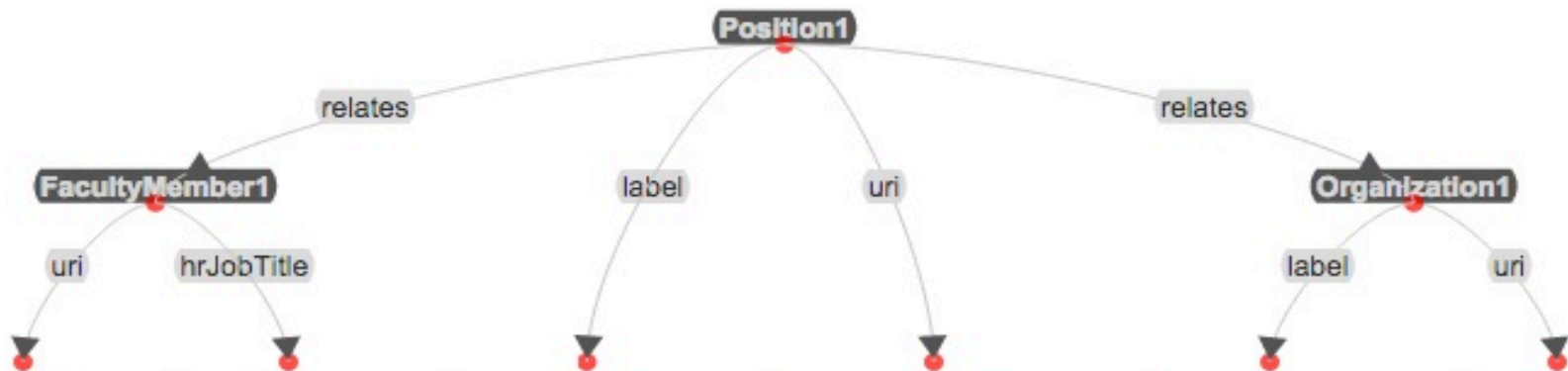
Workbench: person N-Triples

Subject	Predicate	Object	Context
http://vivo.northwestern.edu/individual/2001-01-01T00:00:00	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#DateTimeValue	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/2001-01-01T00:00:00	http://vivoweb.org/ontology/core#dateTimePrecision	http://vivoweb.org/ontology/core#yearPrecision	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/2001-01-01T00:00:00	http://vivoweb.org/ontology/core#dateTime	"2001-01-01T00:00:00"	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#FacultyMember	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://www.w3.org/2000/01/rdf-schema#label	"Sadav, Manjit S."	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://vivoweb.org/ontology/core#hrJobTitle	"Professor"	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://vivoweb.org/ontology/core#end	http://vivo.northwestern.edu/individual/2014-01-01T00:00:00	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://vivoweb.org/ontology/core#start	http://vivo.northwestern.edu/individual/2000-10-01T00:00:00	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://vivo.northwestern.edu/ontology/vlocal#netID	"Sadav"	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/n2deco6e9	http://purl.obolibrary.org/obo/ARG_2000028	http://vivo.northwestern.edu/individual/nveard2deco6e9	http://localhost.com/worksheets/person-person_tsv/vivo15
http://vivo.northwestern.edu/individual/nc81ef444	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#FacultyMember	http://localhost.com/worksheets/person-person_tsv/vivo15

Modeling the position file

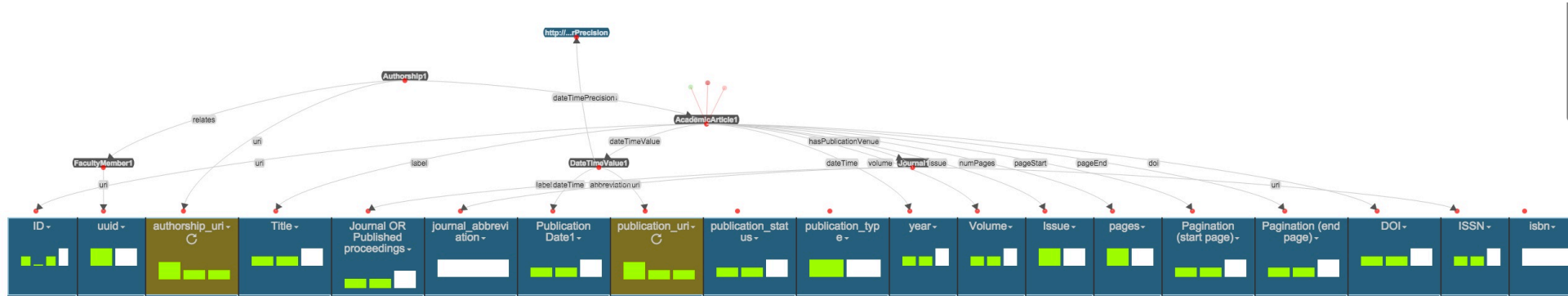
positions - positions.tsv ▾ | [R2RML Model](#) | [RDF](#) ✓

Name: positions - positions.tsv | **Prefix:** s | **Base URI:** http://vivo.northwestern.edu/individual/n

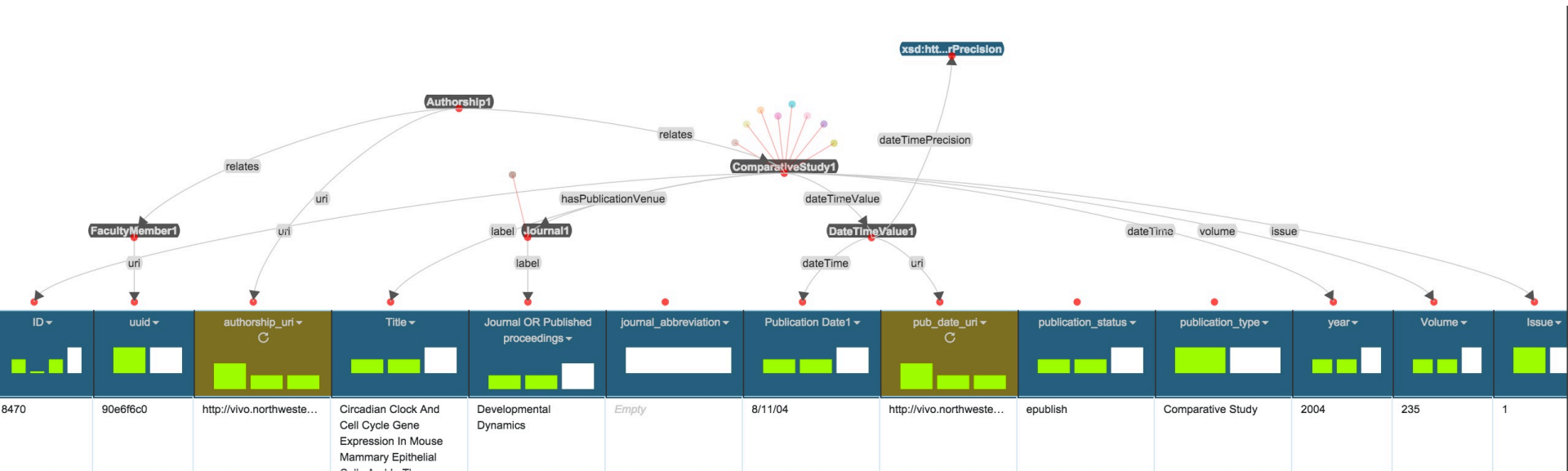


UID ▾	job_title ▾	position_type ▾	position_uri ▾ G	org_name ▾	org_ID ▾
2dec06e9	Professor	Faculty	http://vivo.northwester...	Marketing	8e1497dc

Modeling publications data- academic articles

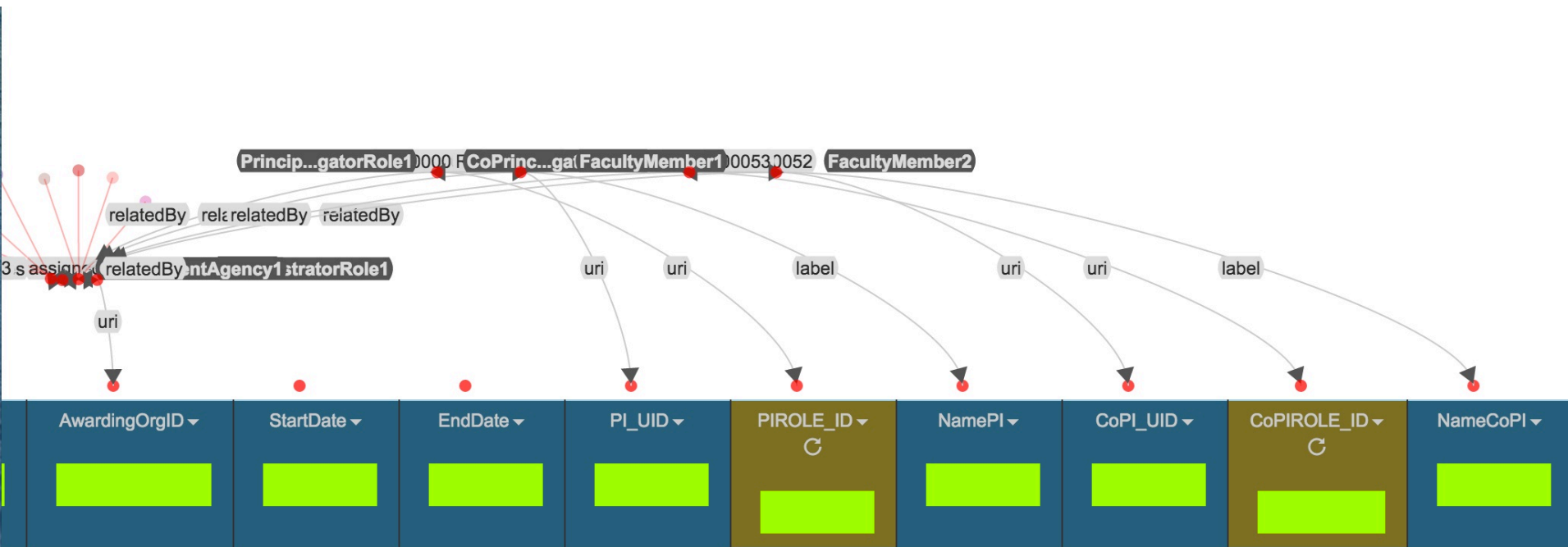


Modeling publications data – comparative study



GrantID ▾	GrantName ▾	AdminDepartmentID ▾	AdminRoleID ▾ ↻	AdminDeptName ▾	Amount ▾	SponAwardID ▾	AwardingOrg ▾	AwardingOrgID ▾

Modeling grants data - continued





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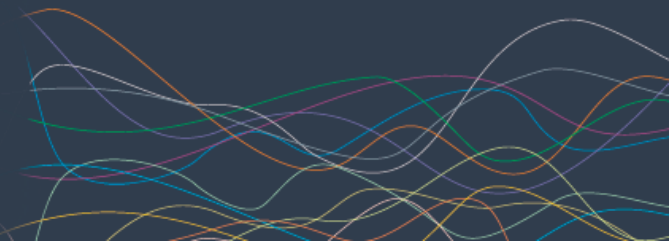
Modeling grants data - RDF

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<http://vivo.northwestern.edu/individual/n2dec06e9> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#FacultyMember> .
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<http://vivo.northwestern.edu/individual/n8e1497dc_role> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> .
<http://vivo.northwestern.edu/individual/nc81ef44_role> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> .
<http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/nc81ef44> .
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<http://vivo.northwestern.edu/individual/n8e1497dc_role> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#AdministratorRole> .
<http://vivo.northwestern.edu/individual/n8e1497dc_role> <http://purl.obolibrary.org/obo/RO_0000052> <http://vivo.northwestern.edu/individual/n8e1497dc> .
<http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/n2dec06e9_role> .
<http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/n2dec06e9> .
<http://vivo.northwestern.edu/individual/n8e1497dc> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#AcademicDepartment> .
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<http://vivo.northwestern.edu/individual/nc81ef44_role> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#CoPrincipalInvestigatorRole> .
<http://vivo.northwestern.edu/individual/nc81ef44> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> .
<http://vivo.northwestern.edu/individual/n2dec06e9> <http://purl.obolibrary.org/obo/RO_0000053> <http://vivo.northwestern.edu/individual/n2dec06e9_role> .
<http://vivo.northwestern.edu/individual/nc81ef44_role> <http://purl.obolibrary.org/obo/RO_0000052> <http://vivo.northwestern.edu/individual/nc81ef44> .
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<http://vivo.northwestern.edu/individual/nc81ef44> <http://www.w3.org/2000/01/rdf-schema#label> "German, Mindy E." .
<http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#assignedBy> <http://vivo.northwestern.edu/individual/norg194fe9> .
<http://vivo.northwestern.edu/individual/norg194fe9> <http://www.w3.org/2000/01/rdf-schema#label> "National Science Foundation" .
<http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/nc81ef44_role> .
```

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Workbench: grants N-Triples

Subject	Predicate	Object
http://vivo.northwestern.edu/individual/n2deco6e9	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#FacultyMember
http://vivo.northwestern.edu/individual/n2deco6e9	http://www.w3.org/2000/01/rdf-schema#label	"Sadav, Manjit S."
http://vivo.northwestern.edu/individual/n2deco6e9	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/n2deco6e9	http://purl.obolibrary.org/obo/RO_0000053	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n8e1497dc	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#AcademicDepartment
http://vivo.northwestern.edu/individual/n8e1497dc	http://www.w3.org/2000/01/rdf-schema#label	"Marketing"
http://vivo.northwestern.edu/individual/n8e1497dc	http://purl.obolibrary.org/obo/RO_0000053	http://vivo.northwestern.edu/individual/n8e1497dc_role
http://vivo.northwestern.edu/individual/n8e1497dc_role	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#AdministratorRole
http://vivo.northwestern.edu/individual/n8e1497dc_role	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/n8e1497dc_role	http://purl.obolibrary.org/obo/RO_0000052	http://vivo.northwestern.edu/individual/n8e1497dc
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/n2deco6e9
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/n8e1497dc_role
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/nc81ef44_role
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/nc81ef44
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n1440213	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#Grant
http://vivo.northwestern.edu/individual/n1440213	http://www.w3.org/2000/01/rdf-schema#label	"Example VIVO Grant"
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#assignedBy	http://vivo.northwestern.edu/individual/norg194fe9
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#sponsorAwardId	"ICER-1440213"
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#totalAwardAmount	"123456"
http://vivo.northwestern.edu/individual/nc81ef44_role	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#CoPrincipalInvestigatorRole
http://vivo.northwestern.edu/individual/nc81ef44_role	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/nc81ef44_role	http://purl.obolibrary.org/obo/RO_0000052	http://vivo.northwestern.edu/individual/nc81ef44
http://vivo.northwestern.edu/individual/nc81ef44	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#FacultyMember
http://vivo.northwestern.edu/individual/nc81ef44	http://www.w3.org/2000/01/rdf-schema#label	"German, Mindy E."
http://vivo.northwestern.edu/individual/nc81ef44	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/nc81ef44	http://purl.obolibrary.org/obo/RO_0000053	http://vivo.northwestern.edu/individual/nc81ef44_role
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#PrincipalInvestigatorRole
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://purl.obolibrary.org/obo/RO_0000052	http://vivo.northwestern.edu/individual/n2deco6e9
http://vivo.northwestern.edu/individual/norg194fe9	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#GovernmentAgency
http://vivo.northwestern.edu/individual/norg194fe9	http://www.w3.org/2000/01/rdf-schema#label	"National Science Foundation"
http://vivo.northwestern.edu/individual/norg194fe9	http://vivoweb.org/ontology/core#assigns	http://vivo.northwestern.edu/individual/n1440213

Workbench: PI role N-Triples

Subject	Predicate	Object
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#PrincipalInvestigatorRole
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://vivoweb.org/ontology/core#PrincipalInvestigatorRole
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://vivoweb.org/ontology/core#relatedBy	http://vivo.northwestern.edu/individual/n1440213
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://purl.obolibrary.org/obo/RO_0000052	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://purl.obolibrary.org/obo/RO_0000052	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://purl.obolibrary.org/obo/RO_0000053	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n2deco6e9_role	http://purl.obolibrary.org/obo/RO_0000053	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/n2deco6e9_role
http://vivo.northwestern.edu/individual/n1440213	http://vivoweb.org/ontology/core#relates	http://vivo.northwestern.edu/individual/n2deco6e9_role

References:

- https://github.com/vioil/ontology_extensions
- <https://github.com/vioil/DataPropeties-id>
- <https://github.com/vioil/R2RML-Karma>
- <https://www.youtube.com/channel/UCb9vsw2XvZDzZtEwe0aH9eA>
- <http://www.isi.edu/integration/karma/>

Thank you Violeta Ilik

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<https://galter.northwestern.edu/staff/Violeta-Ilik>

<http://vivo.vivoweb.org/display/n10603>



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